CLAIMS

What is claimed is:

1. A package with an integral window for housing a microelectronic device, comprising:
an electrically insulating plate having a first surface, an opposing second surface, and an aperture disposed through the plate;
a first electrical conductor disposed on the second surface of the plate; and
an integral window disposed across the aperture and bonded directly to the plate without having a separate layer of adhesive material disposed in-between the window and the plate.

2. The package of claim 1, wherein the electrically insulating plate comprises a multilayered material.

3. The package of claim 1, wherein the at least one electrical conductor comprises a thick-film metallized trace.

4. The package of claim 1, wherein the first electrical conductor comprises an electrical lead.

5. The package of claim 1, wherein the window is bonded directly to a lip recessed inside of the plate.

6. The package of claim 1, wherein the geometrical relationship between the window and the plate comprises an encased joint geometry.

7. The package of claim 1, wherein the geometry of the outer edge of the window comprises a self-locking geometry selected from the group consisting of a tapered outer edge, a convex rounded outer edge, and a chevron-shaped double-tapered outer edge.

8. The package of claim 1, wherein the window is disposed on the first surface of the plate and extends laterally along the first surface a sufficient distance beyond the periphery of the aperture to provide a sufficiently large overlapping area to provide a sufficiently high bond strength.

9. The package of claim 1, wherein the window substantially fills the aperture.

10. The package of claim 9, wherein the window is formed by casting a castable window material directly into the aperture.

11. The package of claim 10, wherein the window has a convex outer shape for concentrating light passing through the window.

12. The package of claim 10, wherein the castable window material comprises a molten glass that has solidified after casting or a transparent liquid polymer that has hardened after casting.

13. The package of claim 1, wherein the window comprises an optically transparent material selected from the group consisting of glass, sapphire, fused silica, clear plastic and clear polymer.

14. The package of claim 1, wherein the window comprises a material selected from the group consisting of silicon, germanium, metal, metal alloy, lithium niobate and lithium tantalate.

15. The package of claim 1, wherein the window comprises a material selected from the group consisting of barium fluoride, calcium fluoride, lithium fluoride, magnesium fluoride, potassium fluoride, sodium chloride, zinc oxide, and zinc selenide.

16. The package of claim 1, wherein the window comprises an anti-reflection coating.

17. The package of claim 1, wherein the window comprises means for filtering selected wavelengths of light.

18. The package of claim 1, wherein the window further comprises an array of binary optic lenslets for optically transforming the light that passes through the window.

19. The package of claim 1, wherein the electrically insulating plate comprises a bulk ceramic material selected from the group consisting of alumina, beryllium oxide, silicon nitride, aluminum nitride, titanium nitride, titanium carbide, and silicon carbide, and combinations thereof.

20. The package of claim 2, wherein the multilayered material comprises a low-temperature cofired ceramic multilayered material fired at a temperature from about 600 C to about 1000 C.

21. The package of claim 2, wherein said multilayered material comprises a high-temperature cofired ceramic multilayered material fired at a temperature from about 1300 C to about 1800 C.

22. The package of claim 2, wherein said multilayered material comprises a polymer-based printed wiring board composition.

23. The package of claim 1, further comprising a first microelectronic device flip-chip interconnected to the first electrical conductor.

24. The package of claim 23, wherein the electrically insulating plate comprises a multilayered material.

25. The package of claim 23, wherein the first microelectronic device comprises a light-sensitive side facing the window.

26. The package of claim 23, further comprising a polymer underfill encapsulating at least one of the flip-chip electrical interconnections.

27. The package of claim 23, wherein said first microelectronic device comprises a chip selected from the group consisting of a semiconductor chip, a CCD chip, a CMOS chip, a VCSEL chip, a laser diode chip, a LED chip, a MEMS chip, and a IMEMS chip.

28. The package of claim 23, further comprising a continuous ring seal disposed in-between the first microelectronic device and the plate.

29. The package of claim 30, wherein the atmosphere in-between the window and the ring seal comprises a dry inert gas other than air, selected from the group consisting of argon, nitrogen, and helium, and combinations thereof.

30. The package of claim 23, wherein the first electrical conductor comprises an electrical lead, and wherein the first electrical device is TAB bonded to the electrical lead.

31. The package of claim 28, further comprising a second microelectronic device, mounted back-to-back to the first microelectronic device.

32. The package of claim 31, wherein the plate further comprises a second electrical conductor disposed on the second surface of the plate, and wherein the second microelectronic device is wirebonded to said second electrical conductor.

33. The package of claim 32, wherein the wirebond and the pair of microelectronic devices are substantially encapsulated in a polymer-based encapsulant.

34. The package of claim 33, further comprising an opening in the polymer-based for providing open access to the front side of the second microelectronic device.

35. The package of claim 34, wherein the opening in the polymer-based encapsulant is defined by a dam that encircles at least some of the front side of the second microelectronic device, which prevents the encapsulant from occluding the front side of the second microelectronic device during encapsulation of the wirebond.

36. The package of claim 35, wherein the dam comprises a U-shaped cap having a top that covers the opening in the polymer-based encapsulant defined by the sidewalls of the U-shaped cap.

37. The package of claim 36, wherein the U-shaped cap is transparent.

38. The package of claim 31, further comprising a protective cover attached to the second surface of the plate, which covers and protects the wirebonds and the pair of microelectronic devices.

39. The package of claim 38, wherein the protective cover is attached to the plate with a material selected from the group consisting of a hermetic sealant and an adhesive.

40. The package of claim 38, wherein the protective cover is transparent.

41. The package of claim 38, wherein the protective cover comprises a window.

42. The package of claim 1;

wherein the package is mounted on, and electrically interconnected to, a printed wiring board;

wherein the printed wiring board comprises an opening through the board; and

wherein the aperture in the package is aligned with the opening in the printed wiring board, thereby allowing light to pass through both the opening and the aperture to interact with the light-sensitive side of the first microelectronic device.

43. A package with an integral window for housing a microelectronic device, comprising:

an electrically insulating plate comprising silicon having a first surface, an opposing second surface, and an aperture disposed through the plate;

first electrical conductor disposed on the second surface of the plate; and

an integral window comprising glass disposed across the aperture and anodically bonded directly to the plate without having a separate layer of adhesive material disposed in-between the window and the plate.

44. The package of claim 43, wherein the window is anodically bonded directly to the first surface of the plate and extends laterally along the first surface a sufficient distance beyond the periphery of the aperture to provide a sufficiently large overlapping area to provide a sufficiently high bond strength.

45. The package of claim 43, wherein the window is anodically bonded directly to a lip recessed inside of the plate.

46. The package of claim 43 further comprising a microelectronic device flip-chip interconnected to the first electrical conductor disposed on the second surface of the plate.

47. A method of fabricating a package with an integral window for housing a microelectronic device, comprising:

a) personalizing a set of individual layers of an electrically insulating multilayer material by removing a cutout shape from each layer; and by depositing a first electrical conductor on the top layer of the set;

b) stacking and registering the set of individually personalized layers, including placing a window at an appropriate location in the stack; wherein the assembled stack comprises an aperture passing completely through the assembled stack; and wherein the window is disposed across the aperture; and

c) processing the assembled stack by applying sufficient pressure and elevated temperature to the assembled stack for a sufficient time to form a consolidated monolithic multilayered plate having an integral window; wherein the window is bonded directly to the plate without having a separate layer of adhesive material disposed in-between the window and the plate.

48. The method of claim 47, wherein the multilayer material comprises a low-temperature green ceramic tape; and further wherein the processing step c) comprises laminating the assembled stack into a rigid block and then cofiring the laminated block at a temperature from about 600 C to about 1000 C.

49. The method of claim 47, wherein the multilayer material comprises a high-temperature green ceramic tape; and further wherein the processing step c) comprises laminating the assembled stack into a rigid block and then cofiring the laminated block at a temperature from about 1300 C to about 1800 C.

50. The method of claim 47, wherein the multilayer material comprises a polymer-based printed wiring board material.

51. The method of claim 47, further comprising after step c), flip-chip bonding a first microelectronic device to the first electrical conductor on the plate, wherein the first microelectronic device has a light-sensitive side facing the window.

52. The method of claim 51, wherein the first microelectronic device comprises an unreleased MEMS structure protected by a sacrificial layer; and further comprising releasing said unreleased MEMS structure by removing said sacrificial layer after the first microelectronic device has been flip-chip interconnected to the plate.

53. The method of claim 52, wherein the sacrificial layer comprises parylene.

54. The method of claim 51, further comprising applying a polymer underfill in-between the first microelectronic device and the plate to form a continuous ring seal.

55. The method of claim 51, further comprising applying a polymer encapsulant to encapsulate the first microelectronic device and the flip-chip interconnections.

56. The method of claim 51, further comprising attaching a protective cover to the plate to cover and protect the first microelectronic device and the flip-chip electrical interconnections.

57. The method of claim 47, further comprising providing a pair of first and second microelectronic devices bonded together back-to-back; and then flip-chip bonding the first microelectronic device second microelectronic device to the first electrical conductor on the plate, wherein the first microelectronic device has a light-sensitive side facing the window; and then wirebonding the second microelectronic device to a second electrical conductor on the plate.

58. The method of claim 57, further comprising applying a polymer underfill in-between the first microelectronic device and the insulating plate to form a continuous ring seal.

59. The method of claim 57, further comprising applying a polymer encapsulant to encapsulate the first and second microelectronic devices, and the flip-chip and wirebonded electrical interconnections.

60. The method of claim 57, further comprising attaching a protective cover to the plate to cover and protect the first and second microelectronic devices, and the flip-chip and wirebonded electrical interconnections.

61. The method of claim 47, further comprising depositing a metal or metal alloy coating onto the outer edge of the window prior to bonding the window to the plate.

62. The method of claim 57, wherein the second microelectronic device comprises a second light-sensitive area with a dam encircling said second light-sensitive area; and further comprising applying a polymer encapsulant in-between the dam and the plate to encapsulate the wirebond, while not occluding the second light-sensitive area.

63. A method of housing a microelectronic device in a package with an integral window, comprising:

a) providing the package of claim 1;

b) providing a microelectronic device having a light-sensitive side; and

c) flip-chip bonding the microelectronic device to the first electrical conductor disposed on the second surface of the plate, wherein the light-sensitive side of the microelectronic device faces the window.

64. A method of housing a microelectronic device in a package with an integral window, comprising:

a) providing the package of claim 43;

b) providing a microelectronic device having a light-sensitive side; and

c) flip-chip bonding the microelectronic device to the first electrical conductor disposed on the second surface of the plate, wherein the light-sensitive side of the microelectronic device faces the window.